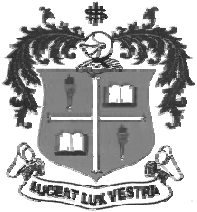# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **COMPUTER SCIENCE**

FIFTH SEMESTER – **NOVEMBER 2013**

**CS 5402 - OPERATIONS RESEARCH**

Date : 12/11/2013          Dept. No.                    Max. : 100 Marks
Time : 9:00 - 12:00

## SECTION-A

**ANSWER ALL THE QUESTIONS:**                                                      (10X2=20)

1. Write a note on slack and surplus variables.
2. What is unbounded solution?
3. When is transportation problem said to be unbalanced? Give an example.
4. Write down the condition for solving Assignment problem.
5. What is Total elapsed time?
6. What is idle time?
7. What does CPM stand for? What is the objective of CPM?
8. Differentiate optimistic and pessimistic time estimate.
9. Define Inventory.
10. What is carrying cost?

## SECTION-B

**ANSWER ALL THE QUESTIONS**:                                                      (5X8=40)

11. a)    A company manufacturers two products A and B in two departments namely assembly department and painting department. It takes two hours in the assembling department and one hour in painting department to manufacture one unit of product A. It takes two hours in the assembling department and 2 hours in painting department for manufacturing one unit of product B. The assembling department works for three 8 hours shift per day and painting department works two 8 hours shift per day. The profit of the product A is Rs.100 and the profit of the product B is Rs.150 per unit. How many units of product A and B to be manufactured so as to maximize the profit for the company?

(OR)

b) Show that the LPP given below has unbounded solution.

Max $Z = 2x_1 + x_2$ subject to the constraints:

$$x_1 - x_2 \leq 10$$
$$2x_1 - x_2 \leq 40$$
$$x_1, x_2 \geq 0$$

12. a)    Obtain an initial basic feasible solution to the following transportation
Problem using North-West Corner Rule.

|   | D | E | F | G | Available |
|---|---|---|---|---|-----------|
| A | 6 | 8 | 8 | 5 | 30 |
| B | 5 | 11 | 9 | 7 | 40 |
| C | 8 | 9 | 7 | 13 | 50 |
| Requirements | 35 | 28 | 32 | 25 | |

(OR)

b) Solve the following Traveling salesman problem.

| | A | B | C | D |
|---|---|---|---|---|
| A | - | 46 | 16 | 40 |
| B | 41 | - | 50 | 40 |
| C | 82 | 32 | - | 60 |
| D | 40 | 40 | 36 | - |

13. a) Solve the following assignment problem:

| | A | B | C | D |
|---|---|---|---|---|
| I | 1 | 4 | 6 | 3 |
| II | 9 | 7 | 10 | 9 |
| III | 4 | 5 | 11 | 7 |
| IV | 8 | 7 | 8 | 5 |

(OR)

b) Find the sequence that minimizes the total elapsed time (in Hrs) required to complete the following task on 2 machines. Also find the total elapsed time and idle time of each machine.

| Jobs | J1 | J2 | J3 | J4 | J5 | J6 |
|---|---|---|---|---|---|---|
| Machine A | 3 | 12 | 5 | 2 | 9 | 11 |
| Machine B | 8 | 10 | 9 | 6 | 3 | 1 |

14. a Write down the difference between PERT & CPM.

(OR)

b) Define the following terms:
a)dummy activity        b) critical path

15. a) Explain the various cost associated with Inventory.

(OR)

b) A stockiest has to supply 12,000 units of a product per year to his customer. The demand is fixed and known and the shortage cost is assumed is to be infinite. The inventory holding cost is Re.0.20 per unit per month and the ordering cost per order is Rs.350. Determine the following

(i) The optimum lot size $q_0$
(ii) Optimum scheduling period $t_0$
(iii) Minimum total variable yearly cost.

## SECTION-C

**ANSWER ANY TWO QUESTIONS:**                                    **(2X20=40)**

16.  i)   Solve by Simplex method :                              **(10)**
Max $Z = 3x_1 + 2x_2 + 5x_3$ Subject to the constraints:

$$x_1 + 2x_2 + x_3 \le 430$$
$$3x_1 + 2x_3 \le 460$$
$$x_1 + 4x_2 \le 420$$
$$x_1, x_2 \ge 0$$

ii)   A firm has 3 factories producing certain product and it is to be transported to five distribution centers. The unit transportation cost (in 100's of Rupees) from factories to the distribution center are given below.

| | Distribution Centers | | | | |
|---|---|---|---|---|---|
| | | D1 | D2 | D3 | D4 | D5 |
| Factories | F1 | 3 | 2 | 3 | 4 | 1 |
| | F2 | 4 | 1 | 2 | 4 | 2 |
| | F3 | 1 | 0 | 5 | 3 | 2 |

Total productions of F1,F2 & F3 are 100,125,75 and the demands of distribution centers D1,D2,D3,D4 & D5 are 100,60,40,75,25 units respectively. Determine the transportation pattern to minimize the overall shipping cost.(Using VAM)                    **(10)**

17. i)  Find the sequence that minimizes the total elapsed time (in Hrs) required to complete the following task on 2 machines. Also calculate total elapsed time and idle time of each machine.**(10)**

| Tasks | A | B | C | D | E | F | G | H | `I |
|---|---|---|---|---|---|---|---|---|---|
| **Machine 1** | 2 | 5 | 4 | 9 | 6 | 8 | 7 | 5 | 4 |
| **Machine 2** | 6 | 8 | 7 | 4 | 3 | 9 | 3 | 8 | 11 |

ii) Given the following information:

| Activity | 1-2 | 1-6 | 2-3 | 2-4 | 3-5 | 4-5 | 6-7 | 5-8 | 7-8 |
|---|---|---|---|---|---|---|---|---|---|
| a | 3 | 2 | 6 | 2 | 5 | 3 | 3 | 1 | 4 |
| m | 6 | 5 | 12 | 5 | 11 | 6 | 9 | 4 | 19 |
| b | 15 | 14 | 30 | 8 | 17 | 15 | 27 | 7 | 28 |

i)      Draw the Project Network
ii)     Find the length and variance of each activity.
iii)    Find the critical path.
iv)     Find the length and variance of the critical path.                    **(10)**

18.    (i)  Define the following Terms:
      a) Reorder Level                 b) Reorder Point                 **(10)**
      c) Safety stock                   d) Shortage

    (ii)   A particular item has a demand of 9,000 units/year. The cost of one procurement is Rs.100 and the holding cost per unit is Rs.2.40 per year. The replacement is instantaneous and no shortages are allowed. Determine
        (i)      The economic lot size,
        (ii)     The number of orders per year,
        (iii)    The time between orders,
        **(iv)**     The total cost per year if the cost of one unit is Re.1.                    **(10)**

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